

INDOOR AIR QUALITY REASSESSMENT

**John R. Briggs Elementary School
96 Williams Road
Ashburnham, Massachusetts**



Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health Assessment
Emergency Response/Indoor Air Quality Program
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Background/Introduction

At the request of some parents, the Massachusetts Department of Public Health's (MDPH) Center for Environmental Health(CEH) conducted a reassessment of the indoor air quality at the John R. Briggs Elementary School (the school), 96 Williams Road, Ashburnham, Massachusetts. On March 11, 2005, Michael Feeney, Director of CEH's Emergency Response/Indoor Air Quality (ER/IAQ) Program, visited the school to conduct an indoor air quality reassessment. Concerns over the potential for pollutants from a capped landfill one half mile north of the school impacting indoor air quality prompted the request.

The school is a brick and steel structure constructed in 1968. Three classrooms (105, 106 and 107) and offices were added in 1991. Two modular classrooms were added within the last several years. The school contains general classrooms, an art room, a library, a cafeteria, a music room and various offices. Classroom windows are openable.

Actions on Recommendations Previously Made by MDPH

MDPH staff had previously visited the building in November of 1999 and March 2003. Two reports were issued making recommendations to improve indoor air quality (MDPH, 2003; MDPH, 2000). A summary of actions taken on previous recommendations is included as Appendix A of this reassessment.

Methods

Air tests for carbon monoxide, carbon dioxide, temperature and relative humidity were conducted with the TSI, Q-Trak, IAQ Monitor, Model 8551. Air tests for airborne particle matter with a diameter less than 2.5 micrometers (PM2.5) were taken with the TSI, DUSTTRAK™ Aerosol Monitor Model 8520. Screening for total volatile organic compounds (TVOCs) was conducted using a Thermo Environmental Instruments Inc., Model 580 Series Photo Ionization Detector (PID).

Results

The school houses approximately 500 kindergarten through fifth grade students and approximately 60 staff members. The tests were taken during normal operations at the school. Test results appear in Table 1.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were elevated above 800 parts per million (ppm) in 20 of 26 areas surveyed, indicating poor air exchange in the majority of areas surveyed. One classroom had double occupancy due to a shared program between two classes. Fresh air in classrooms is supplied by a unit ventilator (univent) system ([Figure 1](#)).

Univents were operating in most of the classrooms examined. Some classrooms univents were deactivated for repair. Obstructions to airflow, such bookcases, tables and desks located in front of univent returns, were seen in a few classrooms; however, the

majority of the units were free of obstructions. As stated in previous MDPH assessments, to function as designed, univent air diffusers and return vents must remain free of obstructions. Importantly, univents must be activated and allowed to operate during classroom occupancy.

Exhaust ventilation in classrooms is provided by a mechanical exhaust system. Classroom air is drawn through a space beneath the closet door and into the closet. The exhaust vents are located in the upper portions of coat closets. This design allows the vents to be easily blocked by materials stored on shelves beneath the exhaust vent. Some of the vents were not drawing air. The exhaust ventilation system does not appear to be coordinated with univent function, but rather is set for deactivation by the thermostat. Exhaust vent deactivation prevents removal of air from the building, which can increase carbon dioxide levels.

Ventilation in the modular classrooms is provided by rooftop air handling units (AHUs). The ventilation system in these classrooms was deactivated during the assessment. The roof itself could not be examined due to the presence of snow. As discussed in previous indoor air quality assessment, the ability of the AHUs appears to be limited by the design of the fresh air intake. Since the AHUs do not have the ability to exhaust air, the operation of these units would likely recirculate air. In this condition, concentrations of normally occurring environmental pollutants can build-up, resulting in increased comfort complaints for some individuals. The thermostat-controlled HVAC system is the primary source of fresh air supply. The modular thermostat has a fan switch that can be set to either “auto” or “on”. The thermostats were found in the "auto" position, which deactivates the HVAC system once the pre-set temperature on the

thermostat is reached. As a result, the AHUs were deactivated and fresh air circulation in the classrooms was limited.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of school occupancy. In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. It is recommended that HVAC systems be re-balanced every five years (SMACNA, 1994). The initial equipment balancing should have occurred after the installation of the new HVAC systems in 2003.

The Massachusetts Building Code requires that each room have a minimum ventilation rate of 15 cubic feet per minute (cfm) per occupant of fresh outside air or openable windows (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air

(ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please consult [Appendix B](#).

The MDPH recommends that indoor air temperatures be maintained in a range between 70° F to 78° F in order to provide for the comfort of building occupants. Temperature readings ranged from 67° F to 73° F, which were in the lower end of the MDPH recommended range in most areas. The two classrooms with temperatures below 70° F had deactivated univents. As discussed, due to repair work being done during the reassessment these univents were not operating. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

The relative humidity ranged from 19 to 28 percent the day of the reassessment, which was below the BEHA recommended comfort range in all areas. The BEHA recommends a range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity

environment. Low relative humidity is a common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

Several classrooms have sinks that have a seam between the countertop and wall. If the seam is not watertight, water can penetrate the countertop seam and collect behind this board. Water penetration and chronic exposure to water can cause porous materials (e.g., wood) to swell and serve as a growth medium for mold.

Other Concerns

Indoor air quality can be negatively influenced by the presence of respiratory irritants, such as products of combustion. The process of combustion produces a number of pollutants. Common combustion emissions include carbon monoxide, carbon dioxide, water vapor and smoke (fine airborne particle material). Of these materials, exposure to carbon monoxide and particulate matter with a diameter of 2.5 micrometers (μm) or less (PM_{2.5}) can produce immediate, acute health effects upon exposure. To determine whether combustion products were present in the school environment, BEHA staff obtained measurements for carbon monoxide and PM_{2.5}.

Carbon monoxide is a by-product of incomplete combustion of organic matter (e.g., gasoline, wood and tobacco). Exposure to carbon monoxide can produce immediate and acute health affects. Several air quality standards have been established to address carbon monoxide and prevent symptoms from exposure to these substances. The MDPH established a corrective action level concerning carbon monoxide in ice skating

rinks that use fossil-fueled ice resurfacing equipment. If an operator of an indoor ice rink measures a carbon monoxide level over 30 ppm, taken 20 minutes after resurfacing within a rink, that operator must take actions to reduce carbon monoxide levels (MDPH, 1997).

ASHRAE has adopted the National Ambient Air Quality Standards (NAAQS) as one set of criteria for assessing indoor air quality and monitoring of fresh air introduced by HVAC systems (ASHRAE, 1989). The NAAQS are standards established by the US EPA to protect the public health from six criteria pollutants, including carbon monoxide and particulate matter (US EPA, 2000). As recommended by ASHRAE, pollutant levels of fresh air introduced to a building should not exceed the NAAQS levels (ASHRAE, 1989). The NAAQS were adopted by reference in the Building Officials & Code Administrators (BOCA) National Mechanical Code of 1993 (BOCA, 1993), which is now an HVAC standard included in the Massachusetts State Building Code (SBBRS, 1997). According to the NAAQS, carbon monoxide levels in outdoor air should not exceed 9 ppm in an eight-hour average (US EPA, 2000).

Carbon monoxide should not be present in a typical, indoor environment. If it is present, indoor carbon monoxide levels should be less than or equal to outdoor levels. On the day of assessment, outdoor carbon monoxide concentrations were non-detectable (ND) (Table 1). Carbon monoxide levels measured in the school were also ND (Table 1).

As discussed, the US EPA has established NAAQS limits for exposure to particulate matter. Particulate matter is airborne solids that can be irritating to the eyes, nose and throat. The NAAQS originally established exposure limits to particulate matter with a diameter of 10 μm or less (PM₁₀). According to the NAAQS, PM₁₀ levels should

not exceed 150 microgram per cubic meter ($\mu\text{g}/\text{m}^3$) in a 24-hour average (US EPA, 2000). These standards were adopted by both ASHRAE and BOCA. Since the issuance of the ASHRAE standard and BOCA Code, US EPA proposed a more protective standard for fine airborne particles. This more stringent, PM_{2.5} standard requires outdoor air particle levels be maintained below $65 \mu\text{g}/\text{m}^3$ over a 24-hour average (US EPA, 2000). Although both the ASHRAE standard and BOCA Code adopted the PM₁₀ standard for evaluating air quality, BEHA uses the more protective proposed PM_{2.5} standard for evaluating airborne particulate matter concentrations in the indoor environment.

Outdoor PM_{2.5} concentrations were measured at $13 \mu\text{g}/\text{m}^3$. PM_{2.5} levels measured in the school ranged from 7 to $44 \mu\text{g}/\text{m}^3$ (Table 1), which were above background in some areas but were below the NAAQS of $65 \mu\text{g}/\text{m}^3$. Indoor PM_{2.5} measurements were below or reflected outdoor measurements during all assessments. Frequently, indoor air levels of particulates can be at levels higher than those measured outdoors. A number of mechanical devices and/or activities that occur in schools can generate particulates during normal operation. Sources of indoor airborne particulate may include but are not limited to particles generated during the operation of fan belts in the HVAC system, cooking in the cafeteria stoves and microwave ovens; use of photocopiers, fax machines and computer printing devices, operating an ordinary vacuum cleaner and heavy foot traffic indoors. During the assessment, PM_{2.5} levels in the art room were typically higher than classrooms. These levels can be attributed to art activities.

Indoor air quality can also be negatively influenced by the presence of materials containing volatile organic compounds (VOCs). VOCs are carbon-containing substances that have the ability to evaporate at room temperature. Frequently, exposure to low levels

of total VOCs (TVOCs) may produce eye, nose, throat and/or respiratory irritation in some sensitive individuals. For example, chemicals evaporating from a paint can stored at room temperature would most likely contain VOCs. In an effort to determine whether VOCs were present in the building, air monitoring for TVOCs was conducted. Outdoor air samples were taken for comparison on each day of assessment. Outdoor TVOC concentration was ND (Table 1). Indoor TVOC concentrations were also ND (Table 1).

Concerns were also raised about possible groundwater contamination from a capped landfill located approximately one half mile north of the BES (Picture 1). A number of different conditions appear to make contaminated groundwater penetrating into the building unlikely:

1. If any pollutants were present in local surface/groundwater, the most likely place for such materials to accumulate is in the lowest point of a building (in this case, the crawlspace). The crawlspace beneath the hallway classrooms closest to the capped landfill was examined, since it is the lowest point within the school structure. The crawlspace was found to be dry and free of any accumulated odors or moisture (Picture 2). In addition, air sampling results did not detect VOCs in the ambient air of classrooms nor in the crawlspace.
2. Ventilation/heating system components or electrical conduits are not located in the slab beneath classroom univents (Picture 3). The lack of penetrations through the floor under the univent eliminates a pathway for potential odors to enter classrooms.
3. The BES and the capped landfill are located on the opposite sides of a glen formed by an unnamed brook that passes beneath Williams Road (Map 1, Picture 4). The school is elevated above the level of the brook on a slope formed by hills to the

south/southwest. Groundwater flooding in the crawlspace was not been reported as a reoccurring problem, nor were signs of flooding present in the crawlspace, which eliminates groundwater contamination as a potential odor source.

4. An examination of topographical maps of the area indicate that surface water in the general area would be expected to flow in the same direction and the unnamed brook, an easterly direction *away* from the BES to wetlands located north of Platts Road. (Maps 2 and 3). The wetlands serve as a tributary to the Whitman River, which flows in an southeasterly direction. Therefore, if pollutants were escaping from the landfill, the direction of surface/groundwater flow should carry the contamination in an easterly direction, away from the grounds of the BES.
5. A second body of water exists between the BES and the capped landfill. This stream run along Turnpike and meets the northwest corner of the intersection of Turnpike and Williams Roads (Picture 5). This stream appears to be created by Turnpike Road, which serves as a natural barrier to water from the north.

Based on available information, it is unlikely that contaminated groundwater is penetrating into the interior of the building.

Parents also expressed concern about electrical power transmission lines that were located in a right-of-way north of the BES (Picture 6). Electrical power transmission lines are a source of electrical and magnetic fields (EMFs); however, the fields tend to drop off after 200 feet (MDPH, 1993). MDPH staff estimate that the electric power transmission lines are located over 330 feet from the closest point of the exterior wall of the BES. Therefore, EMFs from the electrical power lines on the indoor environment are unlikely to impact the health of building occupants.

Of note is the use of cleaning materials in the building. Cleaning products frequently contain ammonium compounds or sodium hypochlorite (bleach-products), which are alkaline materials. The use of these products can provide exposure opportunities in some individuals to a number of chemicals, leading to irritation of the eyes, nose or respiratory tract. Cleaning products containing respiratory and skin irritants appear to be used throughout the building.

Conclusions/Recommendations

A number of improvements have been made to the BES since the previous CEH assessment; however, the design and operation of the exhaust ventilation system continues to limit air exchange. Opening of windows may help to increase comfort levels of individuals in the building. According to school officials, univents were replaced in a number of rooms, which was recommended in the previous BES assessment (MDPH, 2003). To further improve comfort, replacement of the *temperature control* system activating exhaust vents with a *timed* system to coincide with building occupancy would be advisable. This change of ventilation system control would help reduce carbon dioxide levels as well as remove normally occurring environment pollutants. Please note that carbon dioxide levels are typically measured in buildings to determine the adequacy of fresh air. The MDPH strategy to improve air exchange coupled with pollutant source reduction/removal would serve to improve overall indoor air quality in the building. While carbon dioxide levels are an important indicator of fresh air, many of the other recommendations may play a more important role in

reducing symptoms associated with poor indoor air quality (e.g., eliminating moisture sources).

In view of the findings at the time of this assessment, the following recommendations are made:

1. Open windows in classrooms to supplement ventilation as needed.
2. Examine the feasibility of replacing exhaust system control with a manual system.
3. Set modular AHUs thermostat fan to the “on” setting to operate continuously during school hours.
4. In order to improve indoor air quality, an increase in the percentage of fresh air supply into the univent system may be necessary. Survey classrooms for univent function to ascertain if an adequate air supply exists for each room.
5. Clear a three-foot space around all exhaust vents where feasible, and reduce stored materials in classroom closets such that airflow is not impeded. Exhaust ventilation is necessary to remove pollutants from the interior of classrooms. If exhaust ventilation cannot be run continuously, adjust unit ventilators to have exhaust run as much as this equipment will allow.
6. Continue with plans to replace water-damaged countertops that could not be sealed.

References

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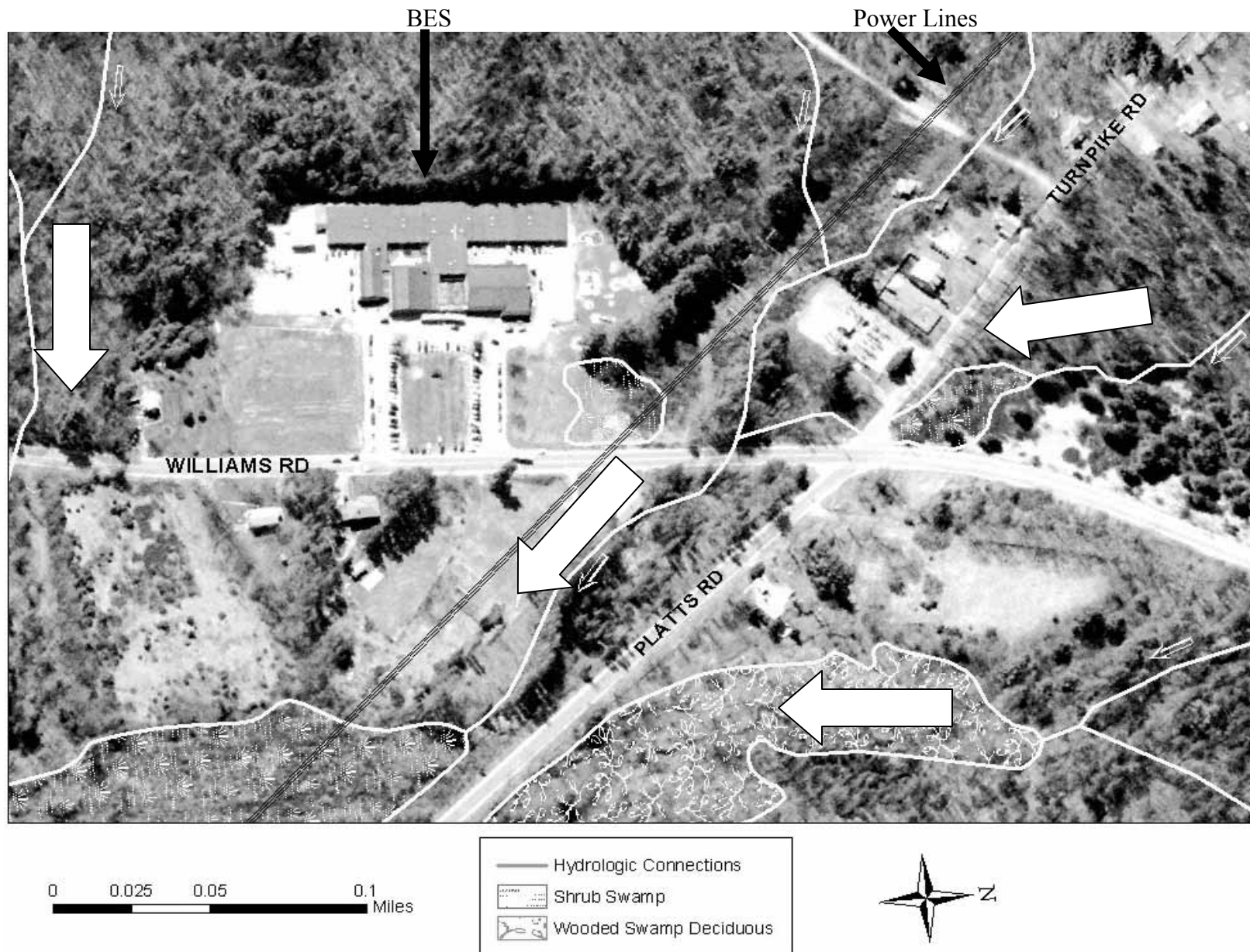
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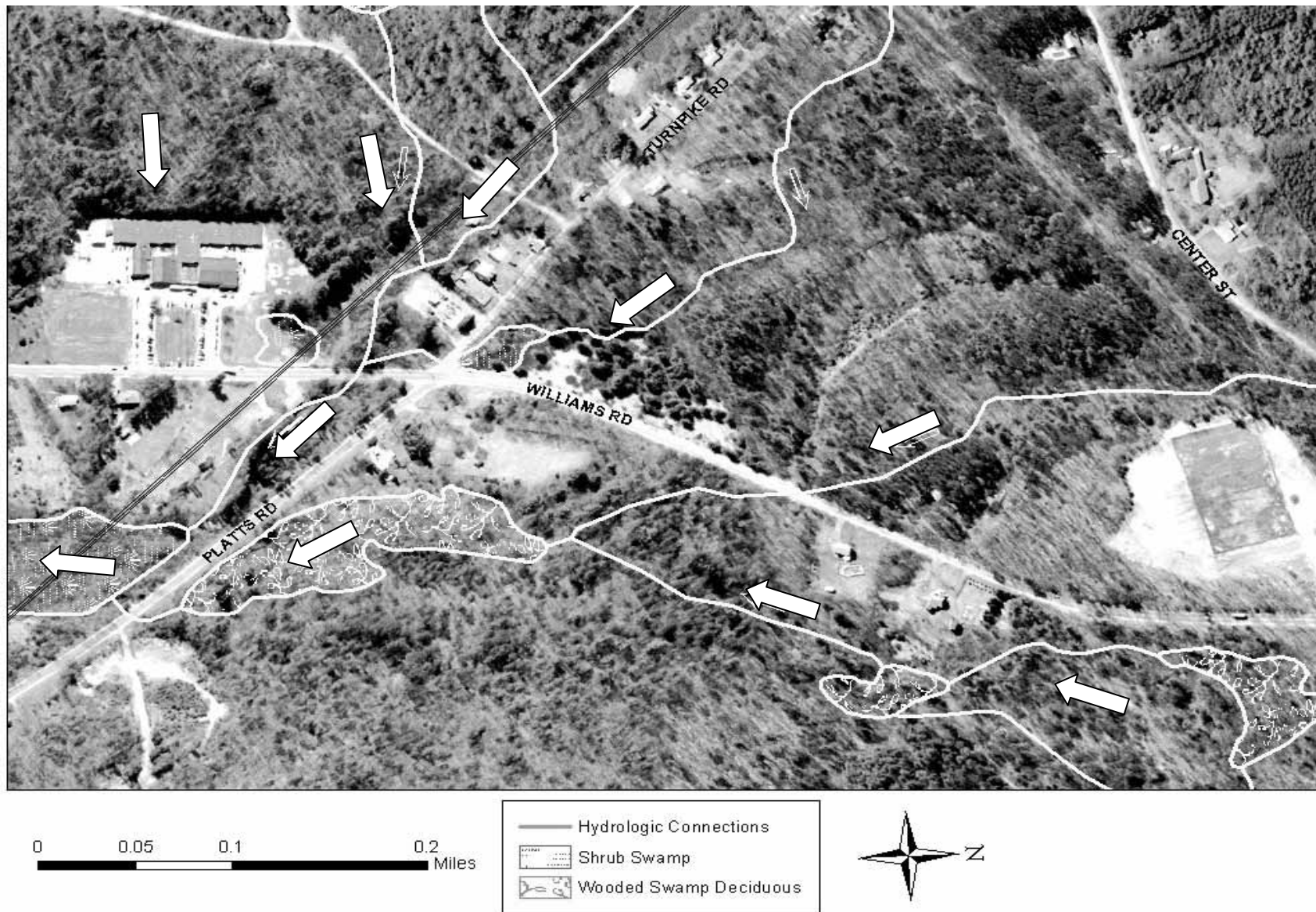
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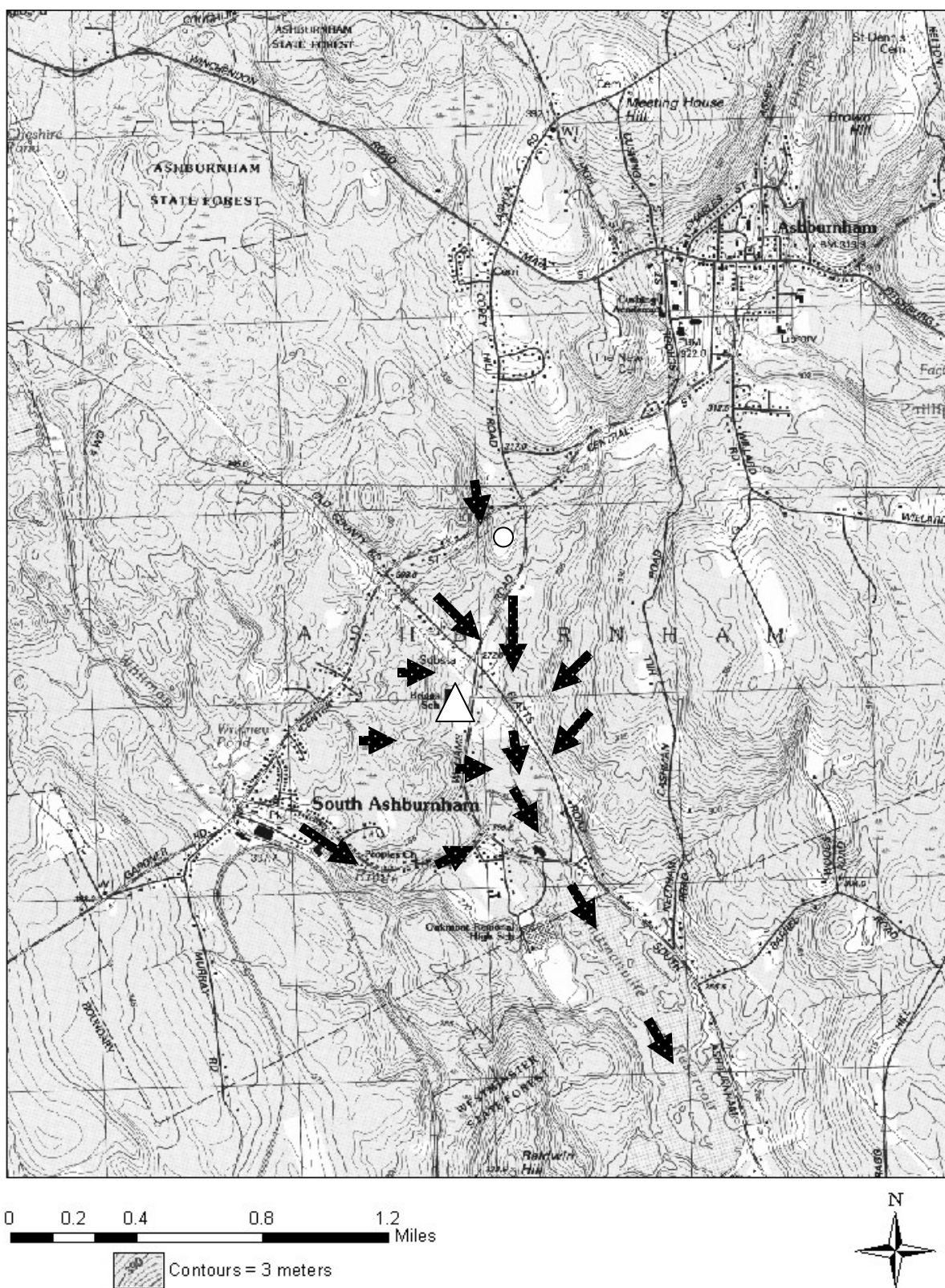
Map 1
Aerial Photo Of Briggs Elementary School, Powerline Right-of-Way and Surface Water
(white arrows indicate surface water flow)



Map 2
Aerial Photo Of Briggs Elementary School, Capped Landfill, Power Line Right-of-Way and Surface Water
(Arrows indicate surface water flow)



Map 3



Black arrows depict surface water flow in the area of BES which drains water to Whitmansville Reservoir (white circle is the approximate location of the capped landfill, triangle is the location of BES)

Picture 1



Capped Landfill One-Half Mile North of BES

Picture 2



Crawlspace Free of Any Accumulated Odors or Moisture

Picture 3



**Univent Floor Is Solid Without Holes/Penetrations
(Note Pipe Curving Towards Rear of Cabinet)**

Picture 4



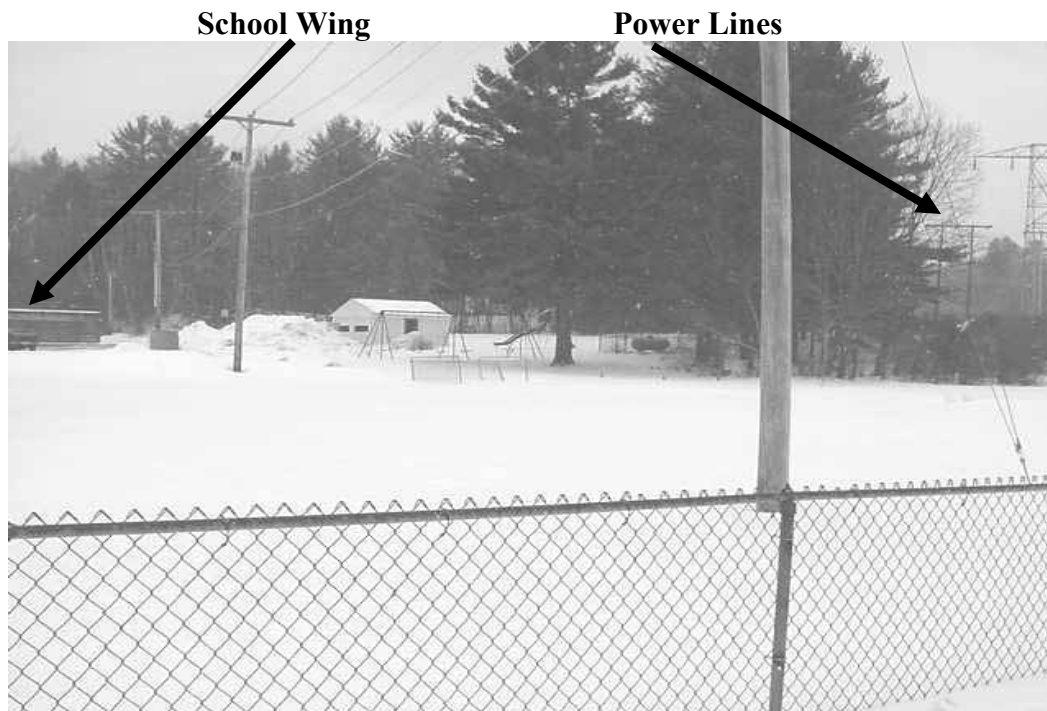
Unnamed Brook that Crosses North of BES

Picture 5



Unnamed Stream at Northwest Corner of the Intersection of Turnpike and Williams Roads

Picture 6



Electrical Power Transmission Lines That Were Located In a Right-Of-Way North Of the BES

John R. Briggs Elementary School
96 Williams Road, Ashburnham, MA

Table 1

Indoor Air Results
March 11, 2005

| Location/ Room | Occupants in Room | Temp (°F) | Relative Humidity (%) | Carbon Dioxide (ppm) | Carbon Monoxide (ppm) | TVOCs (ppm) | PM2.5 (µg/m3) | Windows Openable | Ventilation | | Remarks |
|-------------------|----------------------|--------------|-----------------------------|----------------------------|-----------------------------|----------------|------------------|------------------------------|---|--------------|----------------------|
| | | | | | | | | | Supply | Exhaust | |
| background | 0 | 32 | 20 | 308 | ND | ND | 13 | N # open: 0 # total: 0 | | | |
| 105 | 18 | 73 | 23 | 1171 | ND | ND | 12 | N # open: 0 # total: 0 | Y univent | Y ceiling | |
| 106 | 20 | 72 | 28 | 1591 | ND | ND | 28 | Y # open: 0 # total: 0 | Y univent Blocked by: plant(s) | Y ceiling | Breach sink/counter. |
| 107 | 0 | 71 | 22 | 1216 | ND | ND | 24 | Y # open: 0 # total: 0 | Y univent (off) | N | Hallway DO, |

ppm = parts per million

µg/m3 = micrograms per cubic meter

AD = air deodorizer

AP = air purifier

aqua. = aquarium

AT = ajar ceiling tile

BD = backdraft

CD = chalk dust

CP = ceiling plaster

CT = ceiling tile

DEM = dry erase materials

design = proximity to door

DO = door open

FC = food container

G = gravity

GW = gypsum wallboard

M = mechanical

MT = missing ceiling tile

NC = non-carpeted

ND = non detect

PC = photocopier

PF = personal fan

plug-in = plug-in air freshener

PS = pencil shavings

sci. chem. = science chemicals

TB = tennis balls

terra. = terrarium

UF = upholstered furniture

WD= water-damaged

WP = wall plaster

Comfort Guidelines

Carbon Dioxide: < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Table 1-1

John R. Briggs Elementary School
96 Williams Road, Ashburnham, MA

Indoor Air Results
March 11, 2005

Table 1

| Location/ Room | Occupants in Room | Temp (°F) | Relative Humidity (%) | Carbon Dioxide (ppm) | Carbon Monoxide (ppm) | TVOCs (ppm) | PM2.5 (µg/m3) | Windows Openable | Ventilation | | Remarks |
|-------------------|----------------------|--------------|-----------------------------|----------------------------|-----------------------------|----------------|------------------|------------------------------|--|---------|---|
| | | | | | | | | | Supply | Exhaust | |
| 116 | 2 | 70 | 20 | 609 | ND | ND | 16 | Y # open: 0 # total: 0 | Y | Y | Hallway DO, |
| 117 | 2 | 70 | 20 | 540 | ND | ND | 10 | Y # open: 0 # total: 0 | Y univent | Y | Hallway DO, closet, Comments : class gone 25 min. |
| 118 | 19 | 70 | 20 | 750 | ND | ND | 10 | Y # open: 0 # total: 0 | Y univent | Y | Hallway DO, closet. |
| 119 | 22 | 70 | 21 | 824 | ND | ND | 9 | Y # open: 0 # total: 0 | Y univent Blocked by: furniture | Y | Hallway DO, closet, breach sink/counter. |

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Table 1-2

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96 Williams Road, Ashburnham, MA

Indoor Air Results
March 11, 2005

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| Location/ Room | Occupants in Room | Temp (°F) | Relative Humidity (%) | Carbon Dioxide (ppm) | Carbon Monoxide (ppm) | TVOCs (ppm) | PM2.5 (µg/m3) | Windows Openable | Ventilation | | Remarks |
|-------------------|----------------------|--------------|-----------------------------|----------------------------|-----------------------------|----------------|------------------|------------------------------|--------------|----------------------------------|--|
| | | | | | | | | | Supply | Exhaust | |
| 120 | 17 | 70 | 22 | 1062 | ND | ND | 19 | Y # open: 0 # total: 0 | Y | Y (off) | Hallway DO, closet, DEM, cleaners. |
| 121 | 1 | 67 | 26 | 768 | ND | ND | 7 | Y # open: 0 # total: 0 | Y univent | Y (off) boxes furniture | Hallway DO, closet, Comments: students gone 45 min prior to sampling. |
| 122 | 20 | 69 | 22 | 879 | ND | ND | 12 | Y # open: 0 # total: 0 | Y univent | Y | Hallway DO, closet, DEM, Comments: vehicle exhaust complaints, permanent markers. |
| 125 | 7 | 72 | 19 | 667 | ND | ND | 11 | N # open: 0 # total: 0 | Y univent | Y (off) | closet, #WD-CT : 1. |

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|-------------------|----------------------|--------------|-----------------------------|----------------------------|-----------------------------|----------------|------------------|------------------------------|--|-----------------------|---|
| | | | | | | | | | Supply | Exhaust | |
| 126 | 19 | 72 | 20 | 884 | ND | ND | ND | N # open: 0 # total: 0 | Y | Y (off) | Hallway DO, breach sink/counter. |
| 127 | 21 | 72 | 27 | 1778 | ND | ND | 18 | Y # open: 0 # total: 0 | Y univent (off) | Y (off) | Nests. |
| 128 | 4 | 73 | 22 | 1144 | ND | ND | 16 | N # open: 0 # total: 0 | Y univent (off) | Y ceiling (off) | Hallway DO, Inter-room DO, |
| 130 | 35 | 71 | 25 | 1902 | ND | ND | 15 | Y # open: 0 # total: 0 | Y univent Blocked by: furniture | Y | Hallway DO, breach sink/counter, Comments: classroom double occupied. |

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|-------------------|----------------------|--------------|-----------------------------|----------------------------|-----------------------------|----------------|------------------|------------------------------|-------------------------------|------------|--|
| | | | | | | | | | Supply | Exhaust | |
| 131 | 22 | 70 | 22 | 1183 | ND | ND | 20 | Y # open: 0 # total: 0 | Y univent | Y (off) | Hallway DO, closet, breach sink/counter. |
| 132 | 15 | 72 | 22 | 1087 | ND | ND | 13 | Y # open: 0 # total: 0 | Y | Y (off) | Hallway DO, |
| 133 | 0 | 70 | 21 | 755 | ND | ND | 11 | N # open: 0 # total: 0 | Y univent | Y | Closet, Comments: students gone 1/2 hour. |
| 135 | 23 | 72 | 22 | 930 | ND | ND | 13 | N # open: 0 # total: 0 | Y Blocked by: furniture | Y | Hallway DO, |
| Art | 18 | 70 | 21 | 904 | ND | ND | 44 | N # open: 0 # total: 0 | | | |

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UF = upholstered furniture

WD= water-damaged

WP = wall plaster

Comfort Guidelines

Carbon Dioxide: < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Table 1-5

John R. Briggs Elementary School
96 Williams Road, Ashburnham, MA

Indoor Air Results
March 11, 2005

Table 1

| Location/ Room | Occupants in Room | Temp (°F) | Relative Humidity (%) | Carbon Dioxide (ppm) | Carbon Monoxide (ppm) | TVOCs (ppm) | PM2.5 (µg/m3) | Windows Openable | Ventilation | | Remarks |
|-------------------|----------------------|--------------|-----------------------------|----------------------------|-----------------------------|----------------|------------------|------------------------------|--|--------------|--|
| | | | | | | | | | Supply | Exhaust | |
| Cafeteria | 30 | 71 | 25 | 878 | ND | ND | 14 | N # open: 0 # total: 0 | | | Comments: ceiling fan. |
| Gym | 25 | 70 | 25 | 1233 | ND | ND | 23 | N # open: 0 # total: 0 | | | |
| Library | 22 | 72 | 20 | 830 | ND | ND | 9 | N # open: 0 # total: 0 | Y univent Blocked by: furniture | Y | Hallway DO, |
| Modular A | 2 | 69 | 21 | 1465 | ND | ND | 8 | Y # open: 0 # total: 0 | Y ceiling | Y ceiling | Window-mounted AC, #WD-CT: 2, Comments: thermostat fan "auto". |

ppm = parts per million

µg/m3 = micrograms per cubic meter

AD = air deodorizer

AP = air purifier

aqua. = aquarium

AT = ajar ceiling tile

BD = backdraft

CD = chalk dust

CP = ceiling plaster

CT = ceiling tile

DEM = dry erase materials

design = proximity to door

DO = door open

FC = food container

G = gravity

GW = gypsum wallboard

M = mechanical

MT = missing ceiling tile

NC = non-carpeted

ND = non detect

PC = photocopier

PF = personal fan

plug-in = plug-in air freshener

PS = pencil shavings

sci. chem. = science chemicals

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|-------------------|----------------------|--------------|-----------------------------|----------------------------|-----------------------------|----------------|------------------|------------------------------|-------------|---------|--|
| | | | | | | | | | Supply | Exhaust | |
| Modular B | 0 | 68 | 23 | 1423 | ND | ND | 8 | Y # open: 0 # total: 0 | | | Comments: thermostat fan "auto". |
| Teachers Room | 0 | 72 | 22 | 890 | ND | ND | 15 | Y # open: 0 # total: 0 | N | N | Hallway DO, Comments: refrigerator, soda machine. |

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Appendix A

The following is a status report of action(s) taken on previous MDPH recommendations (**in bold**) based on reports from town/building staff, documents, photographs and MDPH staff observations.

- 1) Operate both the univents and exhaust ventilation system continuously during school hours. Operate the modular AHUs continuous during school hours.

Action Taken: Univents and exhaust ventilation system operate as designed by original specifications.

Action Taken: Modular classroom ventilation was operating intermittently during the reassessment with the thermostat fans set in the “automatic” setting. CEH previously recommended that these thermostats be set in the fan “on” setting to maximize air circulation.

- 2) In order to improve indoor air quality, an increase in the percentage of fresh air supply into the univent system may be necessary. Survey classrooms for univent function to ascertain if an adequate air supply exists for each room.

Action Taken: According to school officials, ten univents have been replaced or repaired in classrooms as identified by Head Custodian, Paul Engman. In addition, Pioneer Environmental Engineering reportedly works closely with BES custodial staff to ensure proper operation of the HVAC system. Please refer to ventilation section of assessment for further explanation of conditions noted.

- 3) Clear a three-foot space around all exhaust vents where feasible, and reduce stored materials in classroom closets such that airflow is not impeded. Exhaust ventilation is necessary to remove pollutants from the interior of classrooms. If exhaust ventilation

Appendix A

cannot be run continuously, adjust exhaust unit ventilator to have exhaust run as much as this equipment will allow.

Action Taken: Obstructions to airflow were removed in most classrooms. However several classrooms had furniture located against the univents, impeding airflow to the return vent.

- 4) Repair leaks in gutters. Examine the area above and around exterior wall leaks for mold growth. Disinfect areas of water leaks with an appropriate antimicrobial.

Action Taken: Gutter leaks were repaired. No water leaking over roof edge was noted during the reassessment.

- 5) Examine windows for water penetration and repair where needed. Remove/replace water damaged wood and tiling. Examine areas underneath water-damaged materials for mold growth. Disinfect these areas with an appropriate antimicrobial.

Action Taken: No water penetration was noted during the reassessment

- 6) To control for dusts, a HEPA filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended.

Action Taken: School officials reported the acquisition of a HEPA filter vacuum cleaner.

- 7) Examine the feasibility of directing downspout water away from the base of the portable classroom's exterior wall.

Action taken: Downspouts were not examined during the reassessment.

- 8) Consider replacing the countertop over water-damaged cabinets. Consider using molded countertops to minimize seams where water and dirt can accumulate, thereby decreasing the chance of mold growth.

Appendix A

Action Taken: A number of sink countertops were sealed with a sealant compound.

Some sinks that were examined are scheduled to have countertops replaced during the summer vacation 2005.